**Reference Course Outline for: CSE655: Probabilistic Reasoning**

**Course Lead:**

Dr. Sajjad Haider

**Course Description:**

This course provides an in-depth analysis of Bayesian Belief Networks which have become the tool of choice for reasoning under uncertainty. The course focuses on the syntax and semantics of Bayesian Networks and how to use BNs to model and analyze uncertain situations. Models that aim to integrate time and uncertainty such as dynamic Bayesian networks, dynamic Influence Nets, Markov Nets as well as the learning of structure and parameters of a Bayesian network will be discussed in detail. The course is intended for graduate level CS students and a significant amount of time will be spend on the current research issues in the field of probabilistic reasoning. Students are expected to use various softwares and develop their own tool to implement various reasoning and learning algorithms.  
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**Prerequisite(s):**

This is a programming intensive course and students are required to have good programming skills. The course also requires basic knowledge of probability theory and statistics.

**Course Objectives:**

One para description of the Course objectives.

**Typical Semester in which this course is offered:**

Fall

**Course Outline**

• Knowledge Representation  
• Modeling and Reasoning with Bayesian Networks  
• Handling Knowledge Acquisition Issues  
• Belief Updating in Singly and Multiply Connected Networks  
• Dynamic Bayesian Networks and their Variants  
• Markov Chains  
• Parameter and Structure Learning of Bayesian Networks  
• Papers Reading (a lot of them!)

**Books**

1. F.V. Jensen and T.D. Nielsen, Bayesian Networks and Decision Graphs, Springer, 2007.
2. U.B. Kjaerulff and A.L. Madsen, Bayesian Networks and Influence Diagrams: A Guide to Construction and Analysis, Springer, 2007.
3. P.A. Darwiche, Modeling and Reasoning with Bayesian Networks, Cambridge University Press, 2009.
4. R.E. Neapolitan and X. Jiang, Probabilistic Methods for Bioinformatics: With an Introduction to Bayesian Networks, Morgan Kaufmann Publishers, 2009.
5. K.B. Korb and A.E. Nicholson, Bayesian Artificial Intelligence, Chapman & Hall/CRC, 2003.
6. R.E. Neapolitan, Learning Bayesian Networks, Prentice Hall, 2003.
7. A. Mittal, Bayesian Network Technologies: Applications and Graphical Models, IGI Publishing, 2007.
8. O. Pourret, P. Naïm, and B. Marcot, Bayesian Networks: A Practical Guide to Applications, Wiley, 2008.

**Software**

[Netica](http://www.norsys.com/)  
[Hugin](http://www.hugin.com/)  
[GeNIe](http://genie.sis.pitt.edu/)

**Grading Policy**

2 Midterms 20% (10% each)  
Final 40%  
2 Reports/Projects 40% (20% each)